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A NEW MARINE GENUS, *DOOWIA*, FROM EASTERN AUSTRALIA (AMPHIPODA, GAMMARIDEA)

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Abstract: Two new species of a new genus of amphipod allied to Oedicerotidae, Exoedicerotidae and Paracalliopiidae are described from shallow waters of New South Wales and southern Queensland. The genus forms a distinct branch within this complex, but its precise status is, as yet, undetermined.

A new genus and two new species, *Doowia cooma* nd *D. dexterae* form a separate branch in the complex f families Oedicerotidae, Exoedicerotidae and aracalliopiidae.

Within this complex, two main characters can be used o distinguish between the families: presence or absence f apical spination on uropods 1 and 2; and presence or bsence of major medial setation on the maxillae. The mily Oedicerotidae, restricted thus to those species lack- ig both apical spines on uropods 1 and 2 and major iedial setation on the maxillae, is primarily confined to ie cold northern hemisphere and the deep sea. Most enera belonging to the Exoedicerotidae and the Paracal- opiidae, on the other hand, are found only in the outhern hemisphere, largely in warm and cold temper- e southern Australia and southern South America (old ondwana). They are characterized by the presence of rong medial setation on both pairs of maxillae. Some oedicerotids, such as *Bathyporeiapus* and *Metoediceros*, cking facial setae on maxilla 2, bear dense medio- arginal setae.

Member species of Exoedicerotidae and Paracalliopi- ae are characterized by strong inward twisting of the ical articles of the gnathopods (at least on death); a pability usually marked morphologically by the esence of an antero-basal flange on the propodus(i) of ther gnathopod or both, and apparently facilitated by weakness of the joint between articles 4 and 5. The Ex- dicerotidae are further distinguished by the presence apical spines on the rami of uropods 1 and 2; spines cking in paracalliopiids.

Doowia differs from the Paracalliopiidae in its more rongly oedicerotid-like features such as dorsally con- guous eyes, long peduncle and unarmed rami of uro- d 3, lack of small posteroventral teeth on the epimera d the lack of A and D setae (Stock 1974, Fig. 1:f) on e third article of the mandibular palp. In antiboreal gions *Doowia* and the Paracalliopiidae are clearly diver- nt from oedicerotids and exoedicerotids in the coales- nce of pleonites 5 and 6; though in the tropics this ndition occurs in certain very apomorphic oedicerotids e *Perioculodes* (Thomas & Barnard 1985).

In the above context, no known living species of *owia*, Paracalliopiidae or Exoedicerotidae can be con- ered a model ancestor of the more apomorphic and stly northern Oedicerotidae. Each of the three southern taxa has a presumably irreversible synapomorphic character, such as fused pleonites or flexion of gnathopods. We assume, but the point is debatable, that the presence of strong medial setation on the maxillae is a synplesiomorphy shared by *Doowia*, Paracalliopiidae and Exoedicerotidae, but lost by the Oedicerotidae. We also assume that non-fusion of eyes and presence of apical spines on the rami of uropods 1-2 are synplesiomorphies. The loss of eyes by some Oedicerotidae prevents the use of eye condition as a character at familial level.

Because of the feeble gnathopods, the female of *Doowia* closely resembles some genera of the Exoedicerotidae such as *Parhalimedon* Chevreux (1906) and especially *Methalimedon* Schellenberg (1931). Similarities to *Methalimedon* are seen in the presence of the row of facial setae on maxilla 2, the short article 3 on the mandibular palp, the few tightly packed, thin and sharp mandibular rakers, the thin pereopods 3-4, and the dorsally-coalesced eyes. However, *Methalimedon* has the exoedicerotid character of apically spinose rami of uropods 1-2, and further differs from *Doowia* in the postero-ventral tooth of epimera 2-3, densely setose coxae 1-4, and presence of A-setae on mandibular palp article 3. Only the female of *Methalimedon* is known and possible fusion of pleonites is not described.

Parhalimedon, with type-species *P. turqueti* Chevreux (1906), also has facial setae on maxilla 2, similar mandibular incisor, rakers and pereopods 3-4, but its uropods 1-2 have the exoedicerotid form. It differs from *Doowia* in the more orthodox anterior coxae (densely setose), very elongate and spinose uropod 3, shortened outer rami of uropods 1-2, points on the epimera, slightly excavate coxa 4, constricted article 2 on percopod 7, falciform ordinary article 3 of the mandibular palp with A and D setae, and broadened oostegites; again, sexual dimorphism is not described. *Parhalimedon tropicalis* J. L. Barnard (1961) has coalesced dorsal eyes (unknown in type-species) and though it has many apparent similarities to the type-species, had several missing limbs and other undescribed parts and must be re-evaluated when better material becomes available.

When running the type-species, *Doowia cooma* through keys to the genera of the Oedicerotidae, very little relationship to them is found except, perhaps, to *Paraperioculodes microrhynchus* Ruffo (1949) from Antarctica; the main resemblance between these two species

lying in the male gnathopodal form and the lack, on article 3 of the mandibular palp, of all but E-setae. *P. microrhynchus*, however, has the orthodox oedicerotid character of poorly setose maxillae; it also has a distinct accessory flagellum and a ventrally spinose epimeron 3.

LEGEND

Capital letters on figures denote main parts as follows: A, antenna; B, body; C, coxa; E, epimera; F, accessory flagellum; G, gnathopod; H, head; I, inner plate or ramus; J, oblique dorsal view of eye; L, labium, M, mandible; N, molar; O, outer plate or ramus; P, pereopod; Q, calceolus; R, uropod; S, maxilliped; T, telson; U, labrum; V, palp; W, pleon; X, maxilla; Y, coupling hooks of pleopods; and Z, gill.

Lower case letters to the left of capitals indicate specimens described in captions. Lower case letters to the right of capitals are descriptive: d, from the side; r, right; s, setae removed; and, t, left.

SYSTEMATICS

Doowia, new genus

TYPE SPECIES: *Doowia cooma* new species.

ETYMOLOGY: *Doowia* from Doowi, aboriginal dream spirit; *cooma*, unique, referring to Doowian morphology.

DIAGNOSIS: Body laterally compressed, not toothed, urosomites 2-3 coalesced; head with broad weakly visor-like rostrum, no lateral lobes, with eyes closely contiguous on dorsal side of head. Calceoli of type not shown by Lincoln and Hurley (1981); accessory flagellum absent. Mandibles with toothed incisor, laciniae mobilics, rakers, triturative molar and 3-articulate palp, with article 3 very short and bearing only E-setae. Labium with mandibular lobes and separated fleshy inner lobes. Inner plate of maxilla 1 fully setose medially. Inner plate of maxilla 2 with facial row of medial setae. Inner plate of maxilliped bearing mostly dense apical setae, palp 4-articulate. Gnathopods of twisted form as in Paracalliopiidae and Exoedicerotidae, propodi bending inward from carpi and on gnathopod 1 propodus with flange acting to support this function, carpus apically narrower than propodus. Pereopods of fossorial form similar to Oedicerotidae, Exoedicerotidae and Paracalliopiidae, with pereopods 5-6 short, pereopod 7 greatly elongate, of different form from pereopods 5-6 and with elongate dactyl. Epimera with rounded posteroventral corners. Uropods 1-2 with styliform, apically naked rami. Uropod 3 with elongate peduncle and naked lanceolate rami. Telson short, uncleft.

DESCRIPTION (incorporating characters of genera in families Oedicerotidae, Exoedicerotidae and Paracalliopiidae): Eyes dorsally contiguous but separated by weak mid line. Antenna 1 short, peduncle short, article 3 as long as article 1, flagellum short. Antenna 2 slightly longer than antenna 1. Labrum incised below. Mandibular incisors strongly projecting, weakly toothed; each side with doubled spine-like lacinia mobilis, 3 rakers and no interrakers; mandibular palp article 3 box-like. Mandibular lobes of labium long. Inner plate of maxilla 2 with partial to full row of facial setae, plates subequally broad. Inner plate of maxilliped broad and with mostly apical setae; outer plate large, medially spinose; dactyl of palp unguiform.

Coxae poorly setose, coxa 1 larger than coxae 2-4, coxa 4 tapering and neither excavate nor lobed behind. Coxae and gnathopods showing strong sexual dimorphism. Male gnathopod 2 dominant, carpi of both pairs bearing poorly setose lobe not guarding propodus, carpus narrower than hand at common joint, propodi of gnathopods large, ovato-rectangular, palms long, oblique, dactyls sinuous; female gnathopods feeble, slender, simple, carpus of gnathopod 1 lobate, more markedly lobate on gnathopod 2, dactyls well developed. Pereopods 3-7 with long dactyls; pereopods 3-4 slender. Epimeron 3 dominant. Uropod 2 falling well short of the apices of uropods 1 and 2; uropod 3 well developed but not excessively elongate, rami longer than elongate peduncle, extending equally. Telson ovato-linguiform, entire. Gills on coxae 2-6 in male, often 2-7 in female; oostegites strap shaped, borne on coxae 2-5.

Sexual distinctions: female coxae taller; male bodies smaller, more streamlined, flagellum of antenna 2 longer, article 5 of pereopods 5-6 more elongate, epimera broader, usually armaments fewer, spines on uropod 3 fewer. Coxa 7 with small gill in female, none in male.

RELATIONSHIP: This genus differs from the Oedicerotidae in the strongly setose inner plates of maxillae 1 and 2, the marked sexual dimorphism of the gnathopods, and from most oedicerotids, in the fusion of pleonites 5 and 6. It differs from most of the Exoedicerotidae in the contiguous, dorsally-situated eyes and the absence of apical spination on the rami of uropods 1 and 2; and from the Paracalliopiidae in the fully contiguous eyes and oedicerotid-like epimera. From all three of these families (except the oedicerotid *Paraperioculodes microrhynchus*) it is distinguished by the lack of A and D setae on article 3 of the mandibular palp. It cannot be satisfactorily accommodated in Oedicerotidae, Exoedicerotidae or Paracalliopiidae.

At this time, however, we prefer not to establish new family for *Doowia*. Its position may be better assessed after the completion of J. D. Thomas's cladistic study, at present in progress, of the Oedicerotidae-Exoedicerotidae-Paracalliopiidae complex and allied groups.

Doowia cooma, new species

Figs 1-4

DIAGNOSIS: See key.

DESCRIPTION OF HOLOTYPE MALE "v": Head broad anteriorly, weak rostral margin dipping ventrally and appearing narrow from side but actually broad dorsally; eyes large, black, pressed together but separated by very thin depigmented midline. Lateral cephalic lobes absent.

Antennae short, antenna 1 much shorter than 2, peduncle short and articles 1-3 subequal, flagellum shorter than peduncle, 5-articulate, first 4 articles each with long aesthetasc. Article 1 of antenna 2 not swollen, gland con

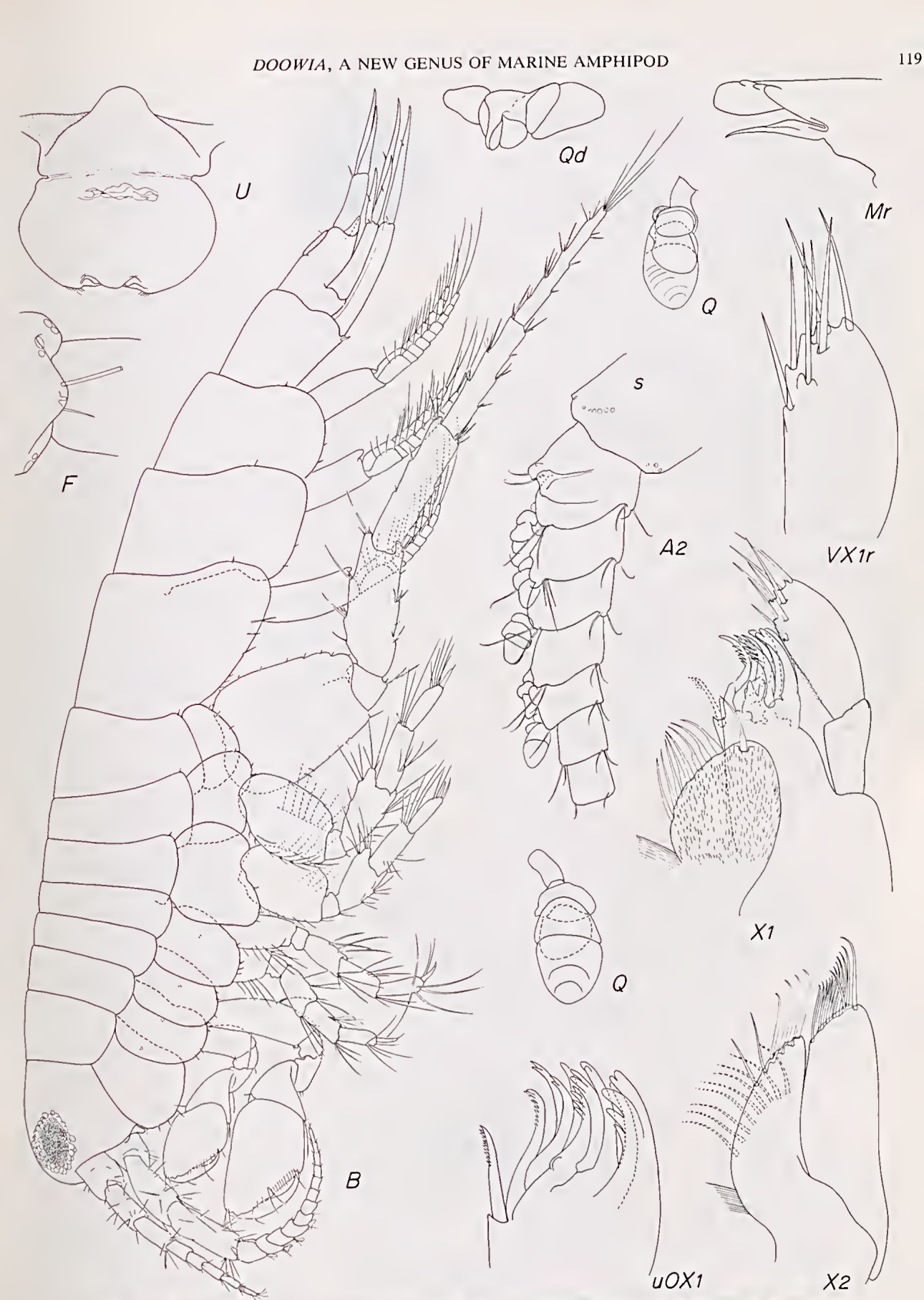

Fig. 1—*Doowia cooma*, new species, unattributed figures, holotype male "v"; 2.20 mm; u, female "u" 2.30 mm.

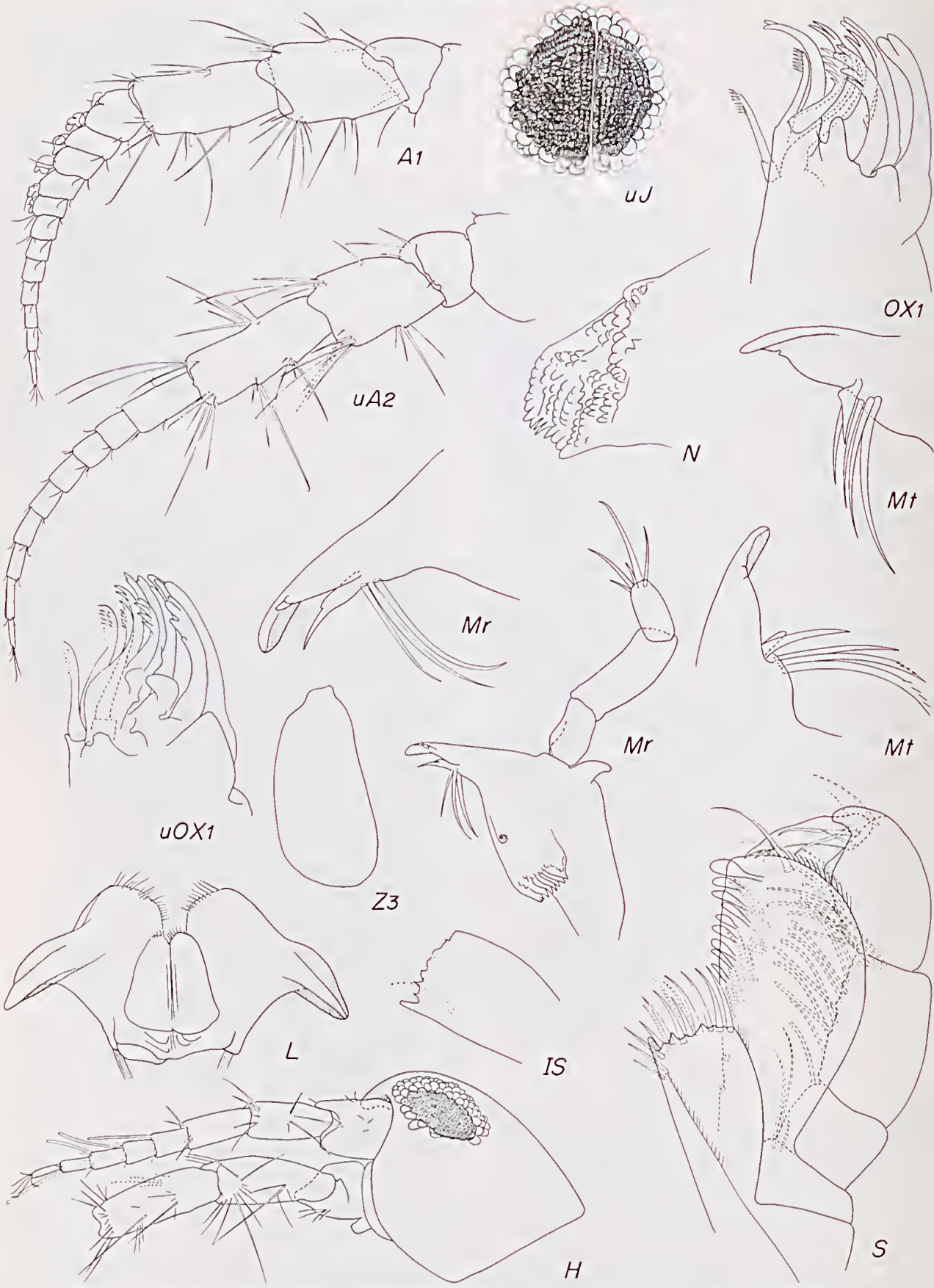

Fig. 2—*Doowia cooma*, new species, unattributed figures, holotype male "v" 2.20 mm; u, female "u" 2.30 mm.

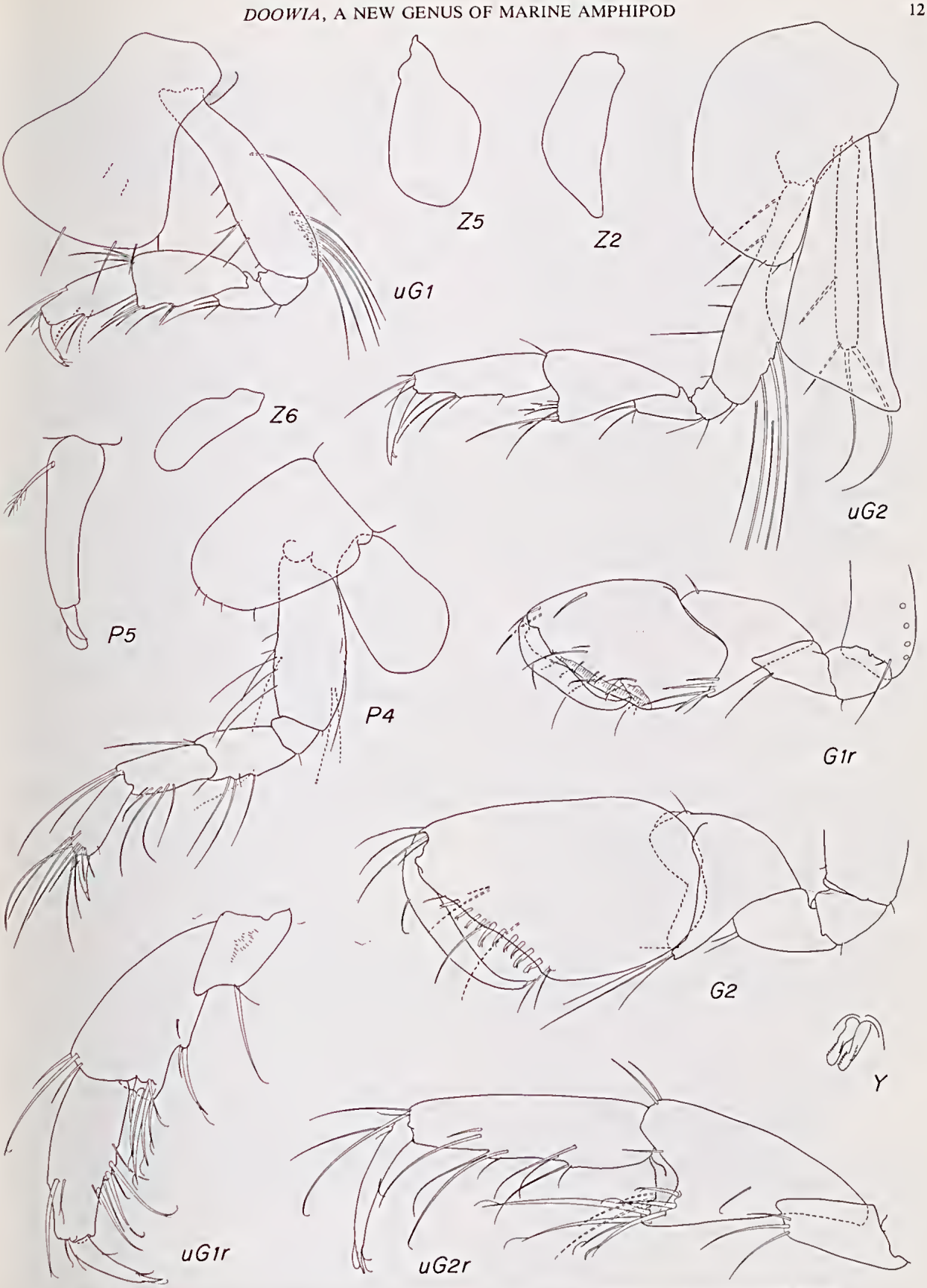

Fig. 3 — *Doowia cooma*, new species, unattributed figures, holotype male "v" 2.20 mm; u, female "u" 2.30 mm.

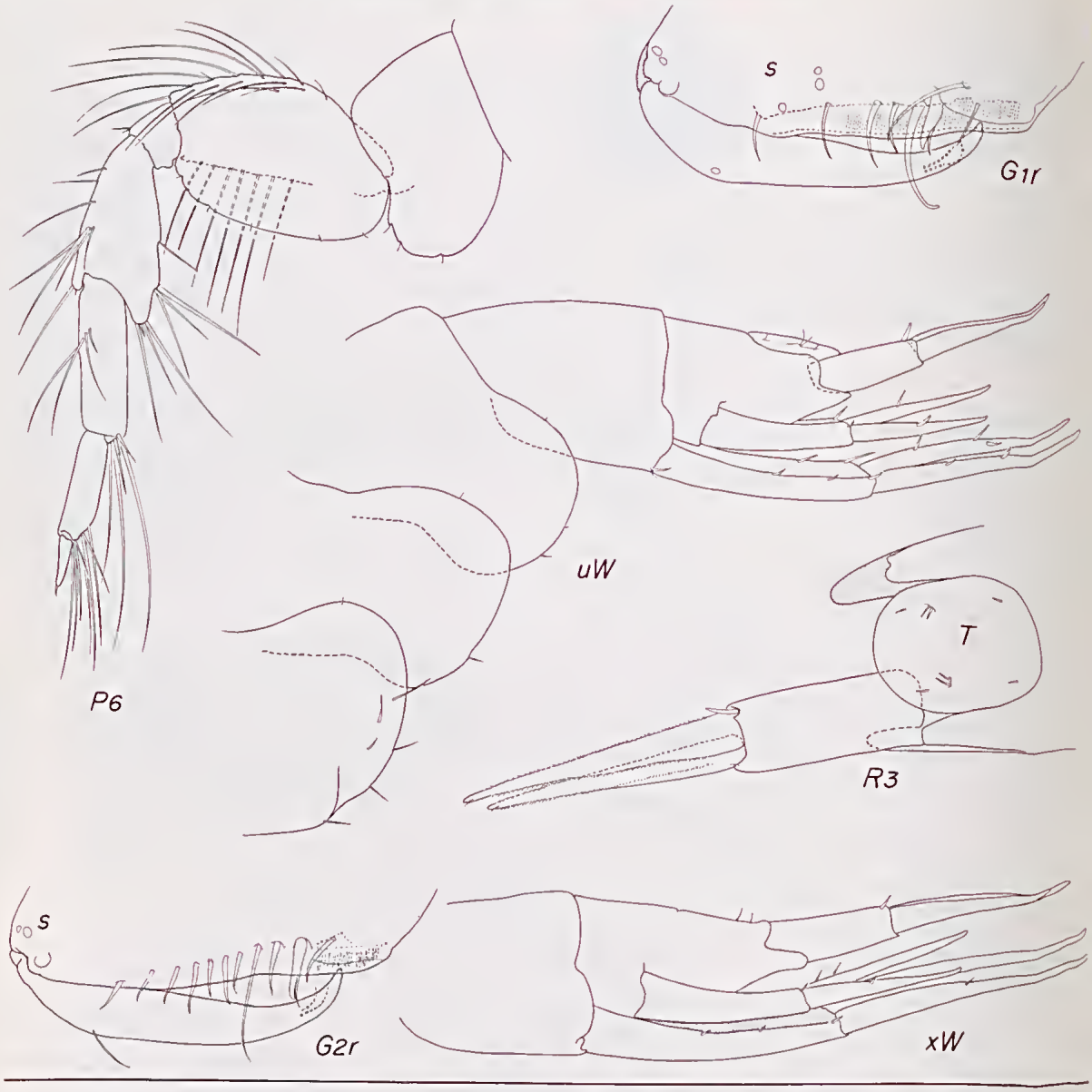

Fig. 4—*Doowia cooma*, new species, unattributed figures, holotype male "v" 2.20 mm; u, female "u" 2.30 mm; x, male "x" 2.21 mm.

KEY TO THE SPECIES OF *Doowia*

Inner plate of maxilla 2 with only 3 facial setae, peduncle of uropod 1 with 1 dorsolateral spine, rami on uropods 1-3 with total aggregate of 13 spines (adults), carpal lobes on male gnathopods slightly elongate, of female gnathopod 2 well developed ..... *D. dexterae*

Inner plate of maxilla 2 with about 9 facial setae, peduncle of uropod 1 with 3 dorsolateral spines, rami on uropods 1-3 with total aggregate of 7 spines (adults), carpal lobes on male gnathopods short, on female gnathopod 2 weak ..... *D. cooma*

of medium size, article 3 short, article 5 slightly longer than 4, flagellum slightly longer than articles 4-5 of peduncle combined, 12-articulate, first 5 basal articles thick and bearing 6 calceoli of special form (Fig. 1, Q), article 1 (incipiently divided at death of specimen), thus with 2 calceoli, remaining articles thinner and ordinary.

Prebuccal mass not projecting anteriorly, labrum divided from epistome, weakly incised below from anterior aspect. Incisors of mandibles thin and strongly projecting, weakly toothed, each side with spine-like, basally inflated or subdivided lacinia mobilis, each side with 3 long rakers, no inter-rakers, molar strongly triturative and bearing weak basal chopper composed of small blunt (or worn) teeth; palp of medium size, article 1 scarcely elongate, article 2 naked, article 3 much shorter than 2, box-like, with 5 diverse setae on right mandible, 4 on left. Mandibular lobes of labium with marginal flanges. Inner plate of maxilla 1 large, sparsely pubescent, medially setose, with one disjunct apical seta; outer plate with 10 spines packed close together in curved formation; palp feeble, thin, article 1 elongate but article 2 longer than 1, with 6-7 apical and subapical stiff setae, symmetrical on both sides. Plates of maxilla 2 of subequal width, outer slightly exceeding inner, inner with strong facial row of setae. Inner plate of maxilliped broad, with one large apico-medial cusp, the truncated apex bearing many setae with scattered cusps and 2 barely separated tooth spines; outer plate large, with 1 apical seta, many medial spatulate spines and ventral pairs of thin, clavate setae; palp articles 1-2 naked laterally, article 2 not elongate, article 3 with apico-lateral lobe and 1 seta, medially with clavate setae; dactyl long, unguiform, with weakly separated apical nail and several accessory setules.

Coxae 1-4 relatively short and extending equally, poorly setose, coxa 1 largest, weakly expanded apically; coxae 3-4 weakly tapering, not excavate nor lobed posteriorly; coxa 5 as long as 4, posterior lobe shortened; coxa 6 as long as posterior lobe of coxa 5, anterior lobe shortened; coxa 7 short and unlobed.

Gnathopods generally similar to one another, but gnathopod 1 small and gnathopod 2 large; carpi with strong subsharp lobe projecting about 45 degrees, lobes weakly setose, propodi enlarged, palms oblique and sinuous, defined by pair of setae, each with pocket for reception of dactylar apex, palm of gnathopod 1 bearing reinforcement sclerites arranged in buffer-pad, palm of gnathopod 2 lined with heavy spines, dactyls curved, sinuous, on gnathopod 1 not extending full width of palm, dactyls with weak apical nail.

Pereopods 3-4 slender, articles 4-5 barely expanded or apically lobate, weakly setose, article 6 with all setae apical, dactyls well developed, with small nail and hyaline lobe. Pereopods 5-6 alike, weakly setose, article 2 ovato-rectangular, with medial midfacial vertical row of setae, article 4 expanded apically, article 5 rectangular, article 6 clavate, again with all setae apical, dactyls like pereopods 3-4. Percopod 7 huge, weakly setose, article 2 longer than wide, proximally broad, tapering distally and postcroventrally lobate, lacking medial setae; article 4 weakly expanded, remaining articles linear, dactyl as long as article 6, with setal groups on both margins and apically. Gills on coxae 2-6, unpleated, not basally lobate, that of coxa 6 reduced.

Epimera all rounded behind, each with 1 posterior setule, epimera 1-3 with 3-2-2 ventral setae, epimeron 1 dominant and also bearing 2 facial setae. Pleopods powerful, peduncles elongate, poorly setose (formula of pleopods 1-3, medial setae = 1-0-2, Lateral-setae = 4-0-5), coupling hooks 2 on all pleopods, rami extending equally, about 95 per cent as long as peduncles, articles on outer and inner rami on pleopods 1-3 = 8-8, 9-8, 9-10, medial setae on article 1 of inner ramus on pleopods 1-3 = 5, 4, 3.

Urosomite 1 with ventral spine at base of uropod 1; uropods 1 and 3 extending equally, uropod 2 extending slightly beyond end of peduncle of uropod 3 or nearly halfway along rami (variable), peduncle of uropod 1 with 3 lateral and 2 medial dorsal spines, outer ramus with 2 marginal spines in tandem, inner with 2 in tandem and third spine forming second row as shown in illustrations; uropod 2 peduncle with one apicolateral, one apicomedial spine, each ramus with one marginal spine. Peduncle of uropod 3 with one apicolateral spine, rami extending equally, longer than peduncle, naked. Telson ovato-linguiform, rounded apically, each side of dorsum with 4 setules in pattern of 1-2-1.

Female "u": Strong sexual dimorphism in antenna 2 and gnathopods; thin, strap-shaped oostegites with few setae present on coxae 2-5; antenna 2 flagellum slender, lacking calceoli; coxa 1 much more adz-shaped than in male, coxa 2 relatively longer and more slender than in male; gnathopods feeble, slender, article 2 with more posteroventral setae than in male, carpi elongate and poorly lobed, propodi slender, simple, dactyls curved but not sinuous.

ILLUSTRATIONS: Appendages to be compared with each other are drawn to the same scale, *viz.*, antennae 1 and 2; coxae 1-4; gnathopods 1 and 2; pereopods 3-4; pereopods 5-7; pleopods 1-3; uropods 1-2; uropod 3 and telson. The magnification is not the same for all groups.

HOLOTYPE: Museum of Victoria (MV), J 13093, male "v", 2.20 mm (illustrated).

TYPE-LOCALITY: Snappermans Beach, New South Wales, 3 January 1981, coll., Dr. Deborah Dexter.

MATERIAL: Type-locality, J 13094 female "u" 2.30 mm (illustrated), J 13095 male "x" 2.21 mm (illustrated), J 13096 male "y" 2.06 mm, J 13097 male "z" 1.88 mm; and, 13 other specimens.

DISTRIBUTION: New South Wales, sand beaches.

Doowia dexterae new species
Figs 5-6

DIAGNOSIS: See key.

DESCRIPTION OF MALE HOLOTYPE "m": Like Holotype of *D. cooma* with following minor distinctions: flagellum of antenna 2 with 13 articles; right lacinia mobilis fully divided and gaping, left almost fully divided but not gaping, E-setae of palp, 7 on right and left; palps of maxilla 1 with 8 or 9 setae; inner plate of maxilla 2 with only 3 of medial setae fully facial, next 4 proximal setae

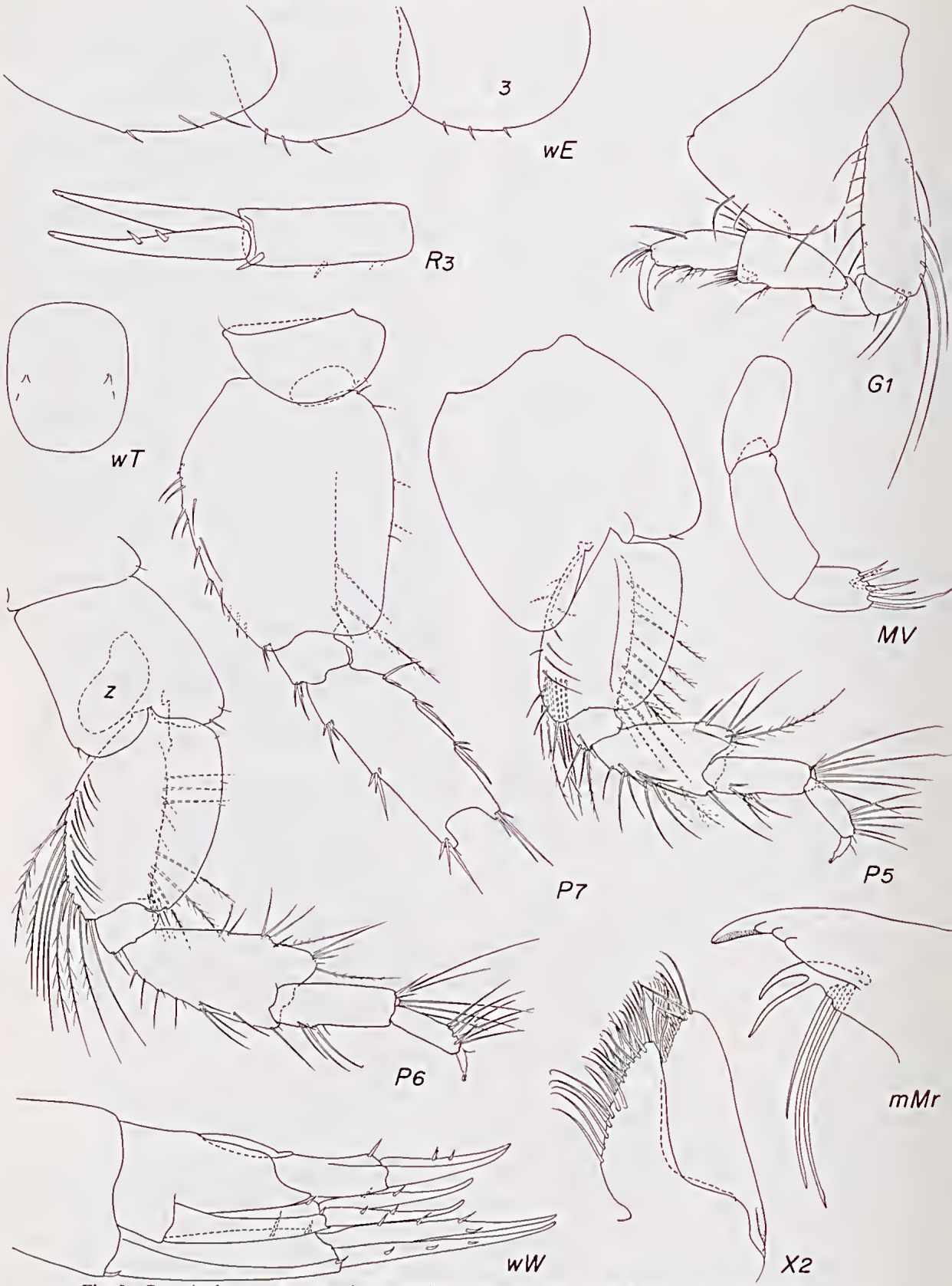

Fig. 5—*Doowia dexterae*, new species, unattributed figures, female "f" 3.54 mm; m, male holotype "m" 2.86 mm; w, female "w" 3.31 mm.

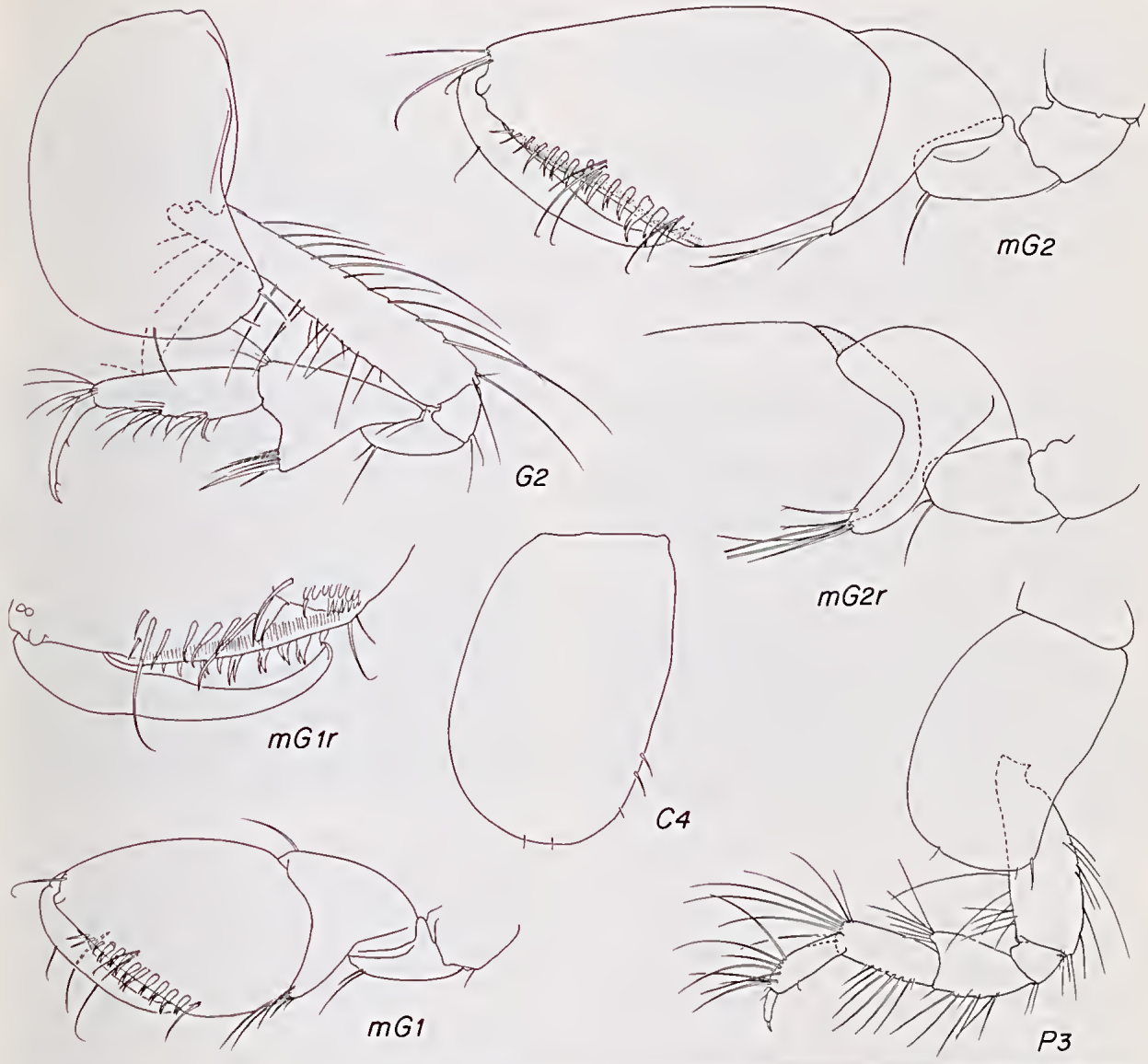

Fig. 6—*Doowia dexterae*, new species, unattributed figures, female "f" 3.54 mm; m, male holotype "m" 2.86 mm.

marginal; inner plate of maxilliped setose but lacking toothed spines of *D. cooma*.

Carpal lobes on gnathopods more elongate. Article 4 of pereopods 6-7 broader. Several posterior setae on article 2 of pereopod 7 elongate.

Spine-seta formula on epimera 1-3: 1 ventral and 3 facial; 2 ventral; 1 ventral. Outer rami of pleopods with 11 articles, inner with 8 or 9, mediobasal setae on article 1 of inner ramus with 4 setae on all pleopods.

Spines on uropods: uropod 1 peduncle lateral 1, medial 1; outer ramus 1, inner ramus 2 and 3 (lateral and medial); uropod 2 peduncle 1, outer ramus 1, inner ramus 2 and 3 (lateral and medial); uropod 3 peduncle 1 medial, outer ramus 0, inner ramus 2 (abnormally 1).

Female "f": Like female of *D. cooma*, thus coxae longer than in male, coxa 7 with small gill, laciniae mobilis not gaping, inner plate of maxilla 1 with 11 or 8 setae (right and left), palps with 7-8 setae; inner plate of maxilla 2 with only 2 facial setae; inner plate of maxilliped more setose, thus with 4 medial setae, spines absent.

Differing from male *D. dexterae* in presence of only 4 articles in flagellum of antenna 1, 9 articles in flagellum of antenna 2, setae and spines slightly thickened (probably body size related); laciniae mobiles of shape shown for *D. cooma*; coxae 5-6 much taller relative to article 2, articles 5-6 smaller relative to article 2; epimeron 1 with 1 ventral and 2 facial setae, epimeron 2 with 3 ventral spines, epimeron 3 with 3 left or 2 right ventral spines.

Lateral peduncular setae on pleopods 1-3, 17-14-10, medial 2-3-10 (groups); articles of outer rami, 12-12-11; of inner rami, 10-10-10; medial setae on inner margin of article 1 on inner ramus, 5-6-6.

Spines on uropods: uropod 1 peduncle lateral 1, outer ramus 3, inner ramus 1 and 3 (lateral and medial); uropod 2 peduncle 1, outer ramus 2, inner ramus 2; uropod 3 peduncle 1, outer ramus 0, inner ramus 2.

Larger female on slide: epimeron 1 with 4 anteroventral setae and 3 facial spines, epimeron 2 with 2 ventral spines, epimeron 3 with 1 ventral spine; outer ramus of uropod 1 with 4 spines, inner with formula of 1-4.

ILLUSTRATIONS: Pereopod 3 reduced to 70% of size of gnathopods 1-2, thus coxa 3 about 1.12 times as long as coxa 2. Appearance of non-illustrated parts like *D. cooma*.

HOLOTYPE: MV J13098, male "m", 2.86 mm (partly illustrated).

TYPE-LOCALITY: Queensland, Brisbane, Redcliffe Beach, sand beach in surf, 15 April 1981, collected by Deborah M. Dexter.

MATERIAL: Type-locality, J 13099, female "f" 3.54 mm (illustrated), J 13100, female "w" 3.31 mm (illustrated), and 4 other specimens; Queensland, South Bribie Island, Bongaree Beach, 15 April 1981, coll., D. M. Dexter, 4 specimens.

ETYMOLOGY: Named for the collector.

RELATIONSHIP: Differing from *D. cooma* in the characters of the key. Although some of the differences between the two species appear to be based on the larger body size of *D. dexterae*, the presence of more spines on the rami of uropods 1-3 combined with the fewer spines on the peduncle of uropod 1, and the difference in setation on the inner plate of the second maxilla, suggests the presence of a genetic distinction between the species.

DISTRIBUTION: Queensland, sand beaches.

ACKNOWLEDGEMENTS

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